

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date
17 March 2005 (17.03.2005)

PCT

(10) International Publication Number
WO 2005/024722 A2

(51) International Patent Classification⁷:

G06T

(21) International Application Number:

PCT/US2004/029857

(22) International Filing Date:

9 September 2004 (09.09.2004)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

60/501,350

9 September 2003 (09.09.2003)

US

(71) Applicant (for all designated States except US): THE BOARD OF TRUSTEES OF THE UNIVERSITY OF ILLINOIS [US/US]; 506 South Wright Street, 352 Henry Administration Building, Urbana, IL 61801 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): GEORGE, Ashvin, K. [IN/US]; 506 E. White Street, No. 13, Champaign, IL 61820 (US). BRESLER, Yoram [US/US]; 414 Brookens Drive, Urbana, IL 61801 (US).

(74) Agent: BURNS, Patrick, G.; Greer, Burns & Crain, Ltd., Suite 2500, 300 S. Wacker Drive, Chicago, IL 60606 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv)) for US only

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A2

WO 2005/024722

(54) Title: FAST HIERARCHICAL TOMOGRAPHY METHODS AND APPARATUS

(57) Abstract: Pixel images f are created from projections $(q_1 \dots q_p)$ by backprojecting (100) selected projections to produce intermediate images (I_1, m) , and performing digital image coordinate transformations (102) and/or resampling (Fig. 31, 186, 192, 196) on selected intermediate images. The digital image coordinate transformations (102) are chosen to account for view angles of the constituent projections of the intermediate images and for their Fourier characteristics, so that the intermediate images may be accurately represented by sparse samples. The resulting intermediate images are aggregated into subsets (104), and this process is repeated in a recursive manner until sufficient projections and intermediate images have been processed and aggregated to form the pixel image f . Digital image coordinate transformation can include rotation (Fig. 18, 102), shearing (Fig. 10B, 120, 122), stretching, contractions (109), etc. Resampling can include up-sampling (101, 106), down-sampling (109), and the like. Projections (Fig. 32, $p\theta_1 \dots p\theta_{18}$) can be created from a pixel image (f), by performing digital image coordinate transformation (202) and/or resampling (204) and/or decimation (Fig. 32, 204; Fig. 33, 212) re-projecting the final intermediate image (208).